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ON THE INFLUENCE OF REPEATED NOISE STRESS ON RATS

by

V. Hrubeš and V. Beneš

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UNEDITED ROUGH DRAFT TRANSLATION

ON THE INFLUENCE OF REPEATED NOISE STRESS ON RATS

By: V. Hrubeš and V. Beneš

English pages: 6

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UBER DEN EINFLUSS WIEDERHOLTER LARMBELASTUNG AUF RATTEN

09 English Title

ON THE INFLUENCE OF REPEATED NOISE STRESS ON RATS

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ABSTRACT: The influence of the effect of repeated noise on rats was investigated. In comparison with untreated control animals and the initial values of the test animals, it was determined that the excretion of catechol amines in the urine is increased, free fatty-acids in the blood plasma increases, there is an increase in the weight of the adrenal glands and the growth of the animal is inhibited. The development of the weight curves also displays characteristic changes. The secretion of 5-hydroxyindolic acetic acid, however, does not change significantly. Consequently, noise is to be used as a model for the study of stress reactions. English Translation: 6 pages.

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ON THE INFLUENCE OF REPEATED NOISE STRESS ON RATS

V. Hrubeš and V. Beneš

Summary

The influence of the effect of repeated noise on rats was investigated. In comparison to untreated control animals and the initial values of the test animals, it was determined that the excretion of catechol amines in the urine is increased, free fatty-acids in the blood plasma increases, there is an increase in the weight of the adrenal glands and the growth of the animal is inhibited. The development of the weight curves also displays characteristic changes. The secretion of 5-hydroxyindolic acetic acid, however, does not change significantly.

Noise not only effects the hearing, but also the central nervous system and, in so doing, has an influence on subordinate systems which results in corresponding stress reactions.

The reaction of the organism to a stress is a result of a simultaneous activation of the sympathoadrenales and the humoral systems, especially with regard to changes in the action of the adrenal cortex. In comparison, catechol amine is at times active as a neuro-chemical mediator in various regulative functions, and also ACTH which is probably liberated under the influence of the stimulation from the hypothalamus (1, 2). Due to the influence of the catechol amine, glucose is mobilized from glycogen and free fatty-acids from the fat deposits. Nevertheless, ACTH takes

place in the metabolism of carbohydrates and fats. Hyperglycaemia is the primary result which is relieved by a hyperlipaemia in another phase. Catechol amine and its satellites are secreted in ever-increasing amounts in the urine.

In our article we concentrate on a number of important components that always take place in the stress reaction, namely, the catechol amine, serotonin and the free fatty-acids in the plasma.

METHODS

Female rats having an initial weight of from 132 to 150 grams that were fed a standard diet were used as test animals. The rats were subjected to the influence of noise for 6 hours a day for 4 days (noise was amplified by means of a transistor generator having an intensity of 95 db); this was divided by a 3 day rest period. Two test series were made up with 10 experimental animals and 10 control animals. The animals in the first series (A) were tested for 2 weeks and the second group (B), 4 weeks. In all animals the body weight was regularly checked. The amount of catechol amine was determined constantly by the spectral photometric method according to Oesterling and Tse (3) and 5-hydroxy indolic acid (5-HIES) was determined colorimetrically according to Udenfriend and associates (4). At the end of the test the animals were killed, the adrenals were recovered and the fatty acids that were not oesterfied in the plasma were determined according to Dole (5).

RESULTS AND DISCUSSION

The response time of the catechol amine excretion is shown in Fig. 1 expressed in extinction values. From this we can see that in the four week experiment, there is a clear increase in the excretion, namely, in comparison to the initial values as well as also to the values in the control group. On the other hand, when looking

for 5 HIES there was no essential difference between the test and control animals. The amount of the free fatty-acids in the plasma is shown in Fig. 2. In both cases higher values were obtained in the test rats than in the control animals. The weight curves are shown in Fig. 3. From the illustration, we can see that the exposed rats gained weight slower. When the exposure time and the resting time was exchanged during a single week, it was especially determined in test B that during the exposure time the rats always suffered from a statistical significant retardation of their growth and in the last period of time a significant weight loss. Partial comparisons of the increase in weight under both time conditions (noise, quiet) during the same week statistically significant differences are shown (Table 1).

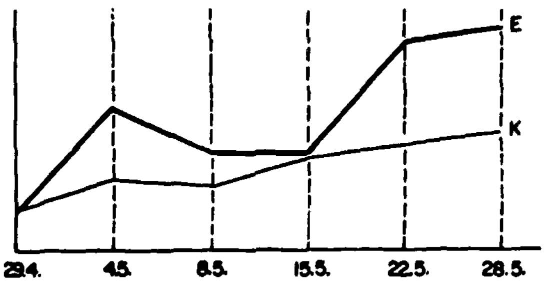

Fig. 1. Transient response of catecholamine excretion (in extinction values).
The long solid line = experiment; the weaker line = control.

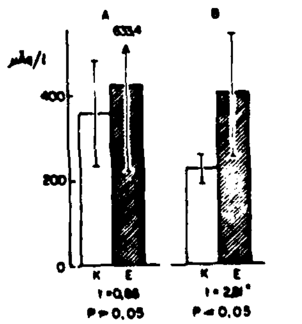

Fig. 2. Free fatty-acid content in plasma.

In comparing the growth curve of control and test rats, we can see that in the last three weeks the difference in the weight increase during the exposure is statistically significant ($P < 0.01$).

The weight of the adrenals, that is, the absolute weight as well as the weight based on the 100 g rat weight is shown in Fig. 4. The adrenals of the test rats were, on the average, heavier; however,

the differences are not significant from a statistic standpoint.

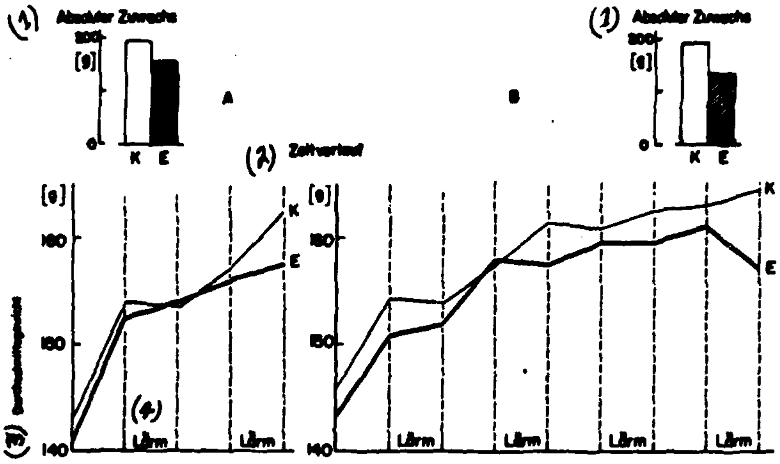

Abb. 3. Gewicht der Versuchstiere.
——— = Experiment; — - - - = Kontrolle

Fig. 3. Weight of the test animals. The solid line = experimental; the weaker line = control.
KEY: (1) absolute increase; (2) transient response; (3) average weight; (4) noise.

Table 1.

Increase in Weight in the Test and Control of Rats, Experiment A.

(1) Lärm $\bar{x}$	$t\,s_{\bar{x}}$	(2) Kontrolle $\bar{x}$	$t\,s_{\bar{x}}$	t
(3) d_1 Ruhe 2,500	± 2,65	d_1 Ruhe 2,875	± 1,59	0,27
(4) d_2 Lärm 0,0	± 2,65	d_2 Ruhe −1,085	± 1,59	0,79

Experiment B

(1) Lärm $\bar{x}$	$t\,s_{\bar{x}}$	(2) Kontrolle $\bar{x}$	$t\,s_{\bar{x}}$	t
(3) d_1 Ruhe 1,625	± 1,43	d_1 Ruhe 2,250	± 0,95	0,82
(4) d_2 Lärm 1,750	± 1,43	d_2 Ruhe −0,459	± 0,95	2,90
d_3 Lärm 0,223	± 1,43	d_3 Ruhe −0,376	± 0,95	0,78
d_4 Lärm 1,375	± 1,43	d_4 Ruhe −0,250	± 0,95	2,13

Experiment B

(5) Zusammenfassung von $d_2 + d_3 + d_4$ (nur während der Expositionszeit)

Lärm $\bar{x}$	$t\,s_{\bar{x}}$	Kontrolle $\bar{x}$	$t\,s_{\bar{x}}$	t
$d_2 + d_3 + d_4$ 1,12	± 0,6980	$d_2 + d_3 + d_4$ −0,36	± 0,49	3,55

KEY: (1) noise; (2) control; (3) quiet; (4) noise; (5) combination of $d_2 + d_3 + d_4$ (only during the exposure time).

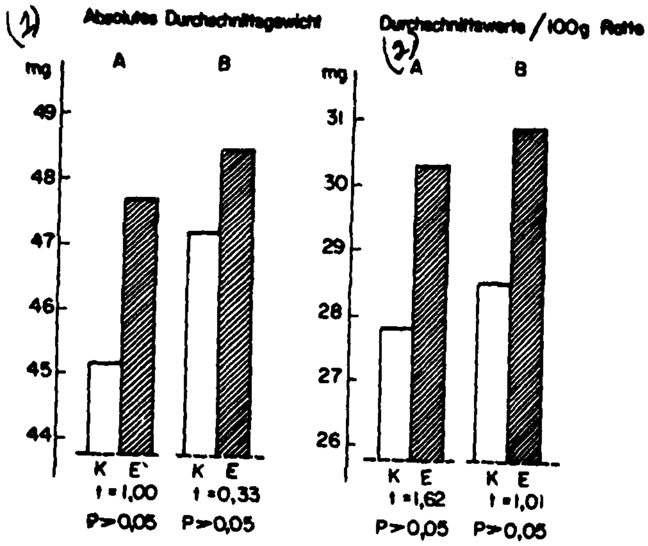

Abb. 4. Nebennieren-Gewicht.
K = Kontrolle; E — Versuchstiere

Fig. 4. The weight of the adrenals.
KEY: (1) absolute average weight;
(2) average weight. K = control; E =
the test animals.

The results of the biochemical investigations are in agreement with those of the other authors. The results on the biological changes proves the work that was done in America on the experimental audiogenic stress (6), (7). From the present work and the results that we obtained earlier (8) - (10), it can be stated that, due to the influence of noise, similar metabolic reactions can occur as those in tests in which other stress types were used. Consequently, noise is to be used as a model for the study of stress reactions throughout.

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